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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/815,274	03/23/2001	Uwe Kruger	15811-002001	4574

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EXAMINER
SHARON, AYAL I

ART UNIT	PAPER NUMBER
2123	

DATE MAILED: 03/14/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/815,274	KRUGER ET AL.	
	Examiner	Art Unit	
	Ayal I Sharon	2123	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 November 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-17* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-17* is/are rejected.

7)☐ Claim(s) *15* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *24 November 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *11/124/2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Introduction

1. Claims 1-17 of U.S. Application 09/815,274, originally filed on 3/23/2001 are presented for examination. The application claims the foreign priority date of U.K. Patent Application 7063.1, filed on 3/23/2000. The amendment filed 11/24/2004 has amended claims 1-3 and 5, and added new claims 7-17.

Claim Interpretations

2. Examiner interprets the limitation of "analyzing the residuals of the response variables" in Claims 3-6 as corresponding to the forms of analysis described in the specification (p.19, line 18 to p.20, line 10). Applicants assert in the amendment filed 11/24/2004 (p.7) that this section of the specification "... describes multiple examples of how abnormal behavior can be identified by analyzing the residuals of the response variables." The types of analysis of the residuals of the response variables described on pp.19-20 are the only ones enabled in the specification.
3. Examiner interprets that Claim 11 consists of a negative limitaion, however, according to MPEP § 2173.05(i), "The current view of the courts is that there is nothing inherently ambiguous or uncertain about a negative limitation. So long as the boundaries of the patent protection sought are set forth definitely, albeit

negatively, the claim complies with the requirements of 35 U.S.C. 112, second paragraph."

Claim Objections

4. Claim 15 is objected to because of the following informalities: it appears to the Examiner that claim 15 should depend from claim 14, and not from claim 4 as written in the claim. Appropriate clarification is required.

Claim Rejections - 35 USC § 101

5. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

6. Claims 1-17 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. The claims, as written, are directed to an abstract mathematical algorithm which is not implemented in the technological arts (e.g. computer-implemented, or embodied on a computer readable medium). The claimed invention is therefore not concrete or tangible. See MPEP §2106 (A), and *In re Warmerdam*, 33 F.3d 1354, 1360, 31 USPQ2d 1754, 1759 (Fed. Cir. 1994). See also *Schrader*, 22 F.3d at 295, 30 USPQ2d at 1459.

7. The "system" claims (Claims 8-13) do not clearly fall into one of the four statutory classes defined under 35 USC § 101:

   a. process

   b. machine (apparatus)

c. manufacture

d. composition of matter.

Examiner interprets the "system" claims as corresponding to apparatus claims. However, these claims are directed to abstract mathematical structures and therefore are not concrete or tangible.

Claim Rejections - 35 USC § 102

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

9. The prior art used for these rejections is as follows:

10. Kruger U., Desforges M.J., Lennox B., Sandoz D.J. "On the Application of Non-Linear Partial Least Squares to Industrial Process Control". DYMAC Conference, Manchester, U.K. September 1-3, 1999 (Henceforth referred to as "**Kruger**").

11. The claim rejections are hereby summarized for Applicant's convenience. The detailed rejections follow.

12. **Claim 8 is rejected under 35 U.S.C. 102(b) as being anticipated by Kruger.**

13. In regards to Claim 8, Kruger teaches the following limitations:

8. (New) A system for monitoring a continuous multivariable process based on a partial least squares model for which more than two latent variables are retained, comprising no more than two statistical monitoring charts representing variation of predictor and response variables together with their residuals, to detect abnormal situations in the continuous multivariable process.

Kruger expressly teaches a "NLDPLS Approach" (See Section 5, pp.2-3) which teaches that "The optimization is a two-stage process." (p.3, left column, para.2), in which "Firstly, an initial population of score vectors are chosen and the model parameters $\underline{a}^{(k)}$ are then calculated …", and then "After that, the reproduction, crossover and mutation procedures are carried out to determine the second population, and again the model parameters are estimated …".

Claim Rejections - 35 USC § 103

14. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

15. The prior art used for these rejections is as follows:

16. Wold et al., U.S. Patent 5,949,678. (Henceforth referred to as "**Wold**").

17. Kruger U., Desforges M.J., Lennox B., Sandoz D.J. "On the Application of Non-Linear Partial Least Squares to Industrial Process Control". DYMAC Conference, Manchester, U.K. September 1-3, 1999 (Henceforth referred to as "**Kruger**").

18. The claim rejections are hereby summarized for Applicant's convenience. The detailed rejections follow.

19. **Claims 1, 7, and 13-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wold in view of Kruger.**

20. In regards to Claim 1, Wold teaches the following limitations:

1. A method of monitoring an industrial process using a partial least squares approach comprising:

constructing predictor and response matricies from reference data of the process,
(Wold, especially: col.9, lines 15 to 52; and col.13, line 12 to col.14, line 27)

In col.9, lines 17-20, "X" is defined as "a matrix with process variables (entries to predict Y)", which corresponds to the claimed "process predictor", and "Y" is defined as "a matrix with 'result' variables", which corresponds to the claimed "response matricies".

the predictor matrix being comprised of signals the manipulated and measured disturbance or cause variables of the process (predictor variables),

In col.9, lines 17-20, "X" is defined as "a matrix with process variables (entries to predict Y)". Examiner finds that "entries to predict Y" correspond to the claimed "predictor variables".

and the response matrix being comprised of the controlled or effect variables of the process (response variables),

In col.9, lines 17-20, "Y" is defined as "a matrix with 'result' variables", which corresponds to the claimed "response matricies". Examiner finds that "'result' variables" correspond to the claimed "response variables".

decomposing the predictor and response matrices into rank one component matrices,
(Wold, especially: col.10, lines 26-40)

In col.10, lines 26-28, Wold teaches that: "The principal component analysis, PCA, is usually based on an analysis of an (NxK) data matrix, Y, which starts with a matrix, centered and scaled into uniform column variance. PCA models this normalized matrix as a product of an (NxA) score matrix T, and an (AxK) loading matrix, P', as well as an (NxK) residual matrix, E."

each of said component matrices being comprised of a vector product in which one vector (the score vector) describes the variation
(Wold, especially: col.9, lines 15 to 52; col.10, lines 26-40)

In col.9, line 44, "T" is defined as "score matrix of X, dimension (NxA)". Examiner finds that vectors which make up the score matrix correspond to the claimed "score vectors".

and the other (the loading vector) the contribution of the score vector to the predictor or response matrix,
(Wold, especially: col.9, lines 15 to 52; col.10, lines 26-40)

In col.9, line 40, "P" is defined as "loading matrix, dimension (KxA)". Examiner finds that vectors which make up the loading matrix correspond to the claimed "loading vectors".

However, Wold does not expressly teach the following limitations:

> decomposition being performed by creating a parametric regression matrix based upon iterations of the decomposition of the predictor and response matrices,
>
> characterised by the creation of a first generalized score vector which describes any significant variation of the process including variations of the predictor and response variables,
>
> and a second generalized score vector which represents the prediction error of the partial least squares model and residuals of the predictor matrix.

Kruger, on the other hand expressly teaches a "NLDPLS Approach" (See Section 5, pp.2-3) which teaches that "The optimization is a two-stage process." (p.3, left column, para.2), in which "Firstly, an initial population of score vectors are chosen and the model parameters $\underline{a}^{(k)}$ are then calculated …", and then "After that, the reproduction, crossover and mutation procedures are carried out to determine the second population, and again the model parameters are estimated …".

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Wold with those of Kruger, because Kruger expressly teaches the following (see p.3, left column, para.2):

> The score vectors, $\underline{u}_k$ and $\underline{t}_k$ should not be determined as for the standard PLS algorithm (Wold, 1989) because they do not adhere to the assumption of linear co-variance. Hence, the score vectors have to be found using a nonlinear optimization method. For NLDPLS, a float-encoding Genetic Algorithm (GA) (Zhang, 1999) is applied.

21. In regards to Claim 7, Wold teaches the following limitations:

7. (New) A method of monitoring an industrial process by a partial least squares model, comprising:

constructing a predictor matrix from reference data of a process being monitored, the predictor matrix comprising signals of predictor variables;
constructing a response matrix from the reference data of the process being monitored, the response matrix comprising signals of response variables; and
(Wold, especially: col.9, lines 15 to 52; and col.13, line 12 to col.14, line 27)

In col.9, lines 17-20, "X" is defined as "a matrix with process variables (entries to predict Y)", which corresponds to the claimed "process predictor", and "Y" is defined as "a matrix with 'result' variables", which corresponds to the claimed "response matricies".

However, Wold does not expressly teach the following limitations:

decomposing the predictor and response matrices into rank one component matrices by creating a parametric regression matrix based upon iterations of a decomposition of the predictor and response matrices,
each of the rank one component matrices comprising a vector product in which a score vector describes a validation and a loading vector describes a contribution of the score vector to the predictor matrix or the response matrix,
characterized by a first generalized score vector which describes any significant variation of the process including variations of the predictor and response variables,
and a second generalized score vector which represents a prediction error of the partial least squares model and residuals of the predictor matrix.

Kruger, on the other hand expressly teaches a "NLDPLS Approach" (See Section 5, pp.2-3) which teaches that "The optimization is a two-stage process." (p.3, left column, para.2), in which "Firstly, an initial population of score vectors are chosen and the model parameters $\underline{a}^{(k)}$ are then calculated …", and then "After that, the reproduction, crossover and mutation procedures are carried out to determine the second population, and again the model parameters are estimated …".

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Wold with those of Kruger, because Kruger expressly teaches the following (see p.3, left column, para.2):

> The score vectors, $\underline{u}_k$ and $\underline{t}_k$ should not be determined as for the standard PLS algorithm (Wold, 1989) because they do not adhere to the assumption of linear co-variance. Hence, the score vectors have to be found using a nonlinear optimization method. For NLDPLS, a float-encoding Genetic Algorithm (GA) (Zhang, 1999) is applied.

22. In regards to Claim 13, Wold does not expressly teach the following limitations:

> 13. (New) The system of claim 8, wherein a first one of the two statistical monitoring charts is based on a first generalized score vector which describes any significant variation of the process including variations of predictor and response variables, and a second statistical monitoring chart is based on a second generalized score vector which represents a prediction error of the partial least squares model and residuals of a predictor matrix.

Kruger, on the other hand expressly teachesthese (see Tables 1 and 2). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Wold with those of Kruger, because Kruger expressly teaches the following (see p.3, left column, para.2):

> The score vectors, $\underline{u}_k$ and $\underline{t}_k$ should not be determined as for the standard PLS algorithm (Wold, 1989) because they do not adhere to the assumption of linear co-variance. Hence, the score vectors have to be found using a nonlinear optimization method. For NLDPLS, a float-encoding Genetic Algorithm (GA) (Zhang, 1999) is applied.

23. In regards to Claim 14, Wold teaches the following limitations:

> 14. (New) An industrial process monitor comprising a multivariate statistical model of the process, the model having been configured by a partial least squares approach,
> wherein predictor and response matrices are constructed from reference data of the process,
> the predictor matrix being comprised of signals of the manipulated and measured disturbance or cause variables of the process (predictor variables),
> and the response matrix being comprised of the controlled or effect variables of the process (response variables),

(Wold, especially: col.9, lines 15 to 52; and col.13, line 12 to col.14, line 27)

In col.9, lines 17-20, "X" is defined as "a matrix with process variables (entries to predict Y)", which corresponds to the claimed "process predictor", and "Y" is defined as "a matrix with 'result' variables", which corresponds to the claimed "response matricies".

However, Wold does not expressly teach the following limitations:

> decomposing the predictor and response matrices into rank one component matrices, each of said component matrices being comprised of a vector product in which one vector (the score vector) describes the variation and the other (the loading vector) the contribution of the score vector to the predictor or response matrix,
> decomposition being performed by the creation of a parametric regression matrix based upon iterations of the decomposition of the predictor and response matrices, the model further configured by the creation of a first generalized score vector which describes any significant variation of the process including variations of the predictor and response variables,
> and a second generalized score vector which represents the prediction error of the partial least squares model and residuals of the predictor matrix.

Kruger, on the other hand expressly teaches a "NLDPLS Approach" (See Section 5, pp.2-3) which teaches that "The optimization is a two-stage process." (p.3, left column, para.2), in which "Firstly, an initial population of score vectors are chosen and the model parameters $\underline{a}^{(k)}$ are then calculated …", and then "After that, the reproduction, crossover and mutation procedures are carried out to determine the second population, and again the model parameters are estimated …".

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Wold with those of Kruger, because Kruger expressly teaches the following (see p.3, left column, para.2):

> The score vectors, $\underline{u}_k$ and $\underline{t}_k$ should not be determined as for the standard PLS algorithm (Wold, 1989) because they do not adhere to the assumption of linear co-variance. Hence, the score vectors have to be found using a nonlinear optimization method. For NLDPLS, a float-encoding Genetic Algorithm (GA) (Zhang, 1999) is applied.

Response to Amendment

Re: Information Disclosure Statement

24. Examiner thanks the Applicants for providing a copy of the requested Krueger reference, as well as the other references provided in the IDS.

Re: Drawings

25. Examiner thanks the applicants for providing the new copy of formal drawings, also submitted on 11/24/2004.

Re: Claim Rejections - 35 USC § 112

26. In regards to claims 3 and 5, Applicants have amended the claims to recite the following limitation:

> " ... further comprising identifying abnormal process behavior, at least in part, by analyzing the residuals of the response variables."

27. Applicants argue (Amendment filed 11/24/2004, p.7, para.6) "... the specification at page 19, line 18 through page 20, line 10 describes multiple examples of how abnormal behavior can be identified by analyzing the residuals of the response variables." Examiner has found this argument to be persuasive in regards to the 35 USC §112, second paragraph rejections, and has withdrawn them.

28. Examiner is interpreting the limitation "...by analyzing the residuals of the response variables" as being limited to the disclosure on the cited pages of the specification.

Re: Claim Rejections - 35 USC § 101

29. Examiner finds that applicants' amendments to independent claim 1 do not overcome the 35 USC § 101 rejections of Claims 1-6. The amended claims are now directed to a useful invention, but they are still not concrete or tangible. These 35 USC § 101 rejections have been applied to the new claims as well.

Re: Claim Rejections - 35 USC § 102

30. Examiner finds applicants' arguments regarding the Wold reference (see amendement filed 11/24/2004, p.9, para.2) overcomes the 35 USC § 102 rejections of Claims 1-6. These rejections have been withdrawn.
31. In particular, Applicants persuasively argue (p.9, para.2) that "... Wold does not disclose the subsequent calculation of 'generalized score vectors' according to claim 1 of the present application, wherein the first generalized score vector describes variation of both the predictor and response variables ..."

Allowable Subject Matter

32. The following is a statement of reasons for the indication of allowable subject matter: Claims 2-6, 9-12 and 15-17 contain limitations that are not explicitly taught in the cited prior art.

Conclusion

33. Applicant's submission of an information disclosure statement under 37 CFR 1.97(c) with the fee set forth in 37 CFR 1.17(p) on 11/24/2004 prompted the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 609(B)(2)(i). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Correspondence Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ayal I. Sharon whose telephone number is (571) 272-3714. The examiner can normally be reached on Monday through Thursday, and the first Friday of a biweek, 8:30 am – 5:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kevin Teska can be reached at (571) 272-3716.

Any response to this office action should be faxed to (703) 872-9306, or mailed to:

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Tech Center 2100 Receptionist, whose telephone number is (571) 272-2100.

Ayal I. Sharon

Art Unit 2123

February 25, 2005

KEVIN J. TESKA
SUPERVISORY
PATENT EXAMINER